SCIENCE:

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WE are pleased to remark some prospect of renewed astronomical activity at the Dearborn Observatory, Chicago. This institution was, for a period of more than ten years, in possession of the largest refracting telescope in existence—the object glass of which has an aperture of eighteen and one-half inches. The great telescopes which have since been built, and are now in process of construction, have the apparent effect of dwarfing the Chicago telescope, which, at the time it was made, was a great advance on every thing that had preceded it. There seems to be the best of reason for doubting, however, whether any other instrument at present in existence is surely superior to the Chicago refractor for efficient astronomical work. MR. S. W. BURNHAM, distinguished for his researches in double stars, speaks with authority in this matter—"I know of no object, faint or otherwise, which has been seen at Washington or elsewhere, that cannot be seen perfectly here [at Chicago] and accurately measured." Professor NEWCOMB, in his "Uranian and Neptunian Systems, Investigated with the 26-inch Equatorial of the United States Naval Observatory, Washington," remarks that Ariel and Umbriel, the inner satellites of Uranus, "are visible only when the atmosphere is very fine, and are then difficult objects," and considers it very doubtful whether these objects have ever been seen with an aperture so small as twelve inches. Director HOUGH, of the Dearborn Observatory, states that near the time of the planet's opposition, these satellites can readily be seen and measured, under ordinary atmospheric conditions, with the Chicago telescope. If, as is quite possible, the Chicago refractor should prove to be quite as effective in actual observation as some of the larger telescopes of a later day, we shall have another of those instances frequently forced upon the astronomer, wherein his computation of the adequacy of a particular instrument does not tally with its observational effectiveness. Every astronomer, then, must regret that so competent an instrument must, through lack of endowment, be lying mainly idle, or, at the most, only employed by those who are able to turn it to scientific observation without pecuniary compensation. The valued work of Mr. BURNHAM with this instrument, in the discovery and observation of double stars, is well known. Professor HOUGH, in connection with Professor COLBERT, conducted a series of observations of Jupiter at the late opposition. Owing to the discordance in the determinations of the ellipticity of the planet's disk from observation, their attention was given to a new determination of this quantity, with these results:

By Professsr HOUGH	1—16.23
By Professor COLBERT	1—16.73

The English Nautical Almanac uses the value 1–13.71, while the value 1–16.40 is adopted in the American Ephemeris. With the same magnifying power, 638 diameters, the absolute polar and equatorial diameters of the planet were observed to be, for the mean distance of Jupiter from the Sun:

	POLAR.	EQUA'L.
By Professor HOUGH	36".319	38".704
By Professor COLBERT	36".030	38".316

Assuming a solar parallax of 8".81, the measures of Professor HOUGH give for the equatorial diameter 90,570 miles, and for the polar diameter 85,000 miles.

Measures of the angle of position of the north edge of the equatorial belt show that it had the same direction around the entire circumference, and that this direction (exactly parallel to the planet's equator) was maintained throughout the entire opposition. Very complete measures of the apparent latitudes and widths of the several components of the belt system of Jupiter were also made, the great red spot co-inciding very nearly with one of these belts. The reduced measures of apparent latitude show very clearly that the belts were arranged symmetrically on either side of the equator, three being in the northern and three in the southern hemisphere of Jupiter. The report on these observations is accompanied with wood-cuts showing the red spot, the belt system, and, to some extent, the structure of the great equatorial belt. From the observations of this spot, Professor COLBERT has computed the time of rotation of the planet on its axis: he finds it to be 9h. 55m. 34.2s., differing about eight seconds from the value hitherto considered the most probable.

Micrometric measures of the diameters of the four satellites of Jupiter were made on three nights, the resulting values being, at mean distance of the planet:

I.	II.	III.	IV.
1".114	0".980	1".778	1".457

The actual diameters of the satellites given by these measures are 2610, 2290, 4160, and 3410 miles, respectively.

But the superior quality of the object glass of the Chicago refractor is more effective with such objects as the satellites of Uranus; micrometric observations were secured as follows:

Of Ariel, on four nights.
Of Umbriel, on one night.
Of Titania, on eight nights.
Of Oberon, on seven nights.

And this, notwithstanding that the observations were begun late in the opposition, and were interrupted by an unusual amount of cloudy weather. We should like to see the superior light-gathering power of this object glass turned toward systematic figuring of the fainter nebulæ.

We may mention the meridian circle of the Dear-

born Observatory—a fine instrument constructed by the celebrated REPSOLDS, of Hamburg, and which must have few equals in this country. It must be the occasion of serious regret that such a splendid piece of mechanism is put only to the task of the mere determination of time, when it is adequate to the determination of the exactest sort of fundamental star-positions. We may be permitted the hope that the creation of a new fund by the citizens of Chicago may ere long contribute to the very possible result of placing the Dearborn Observatory on a permanent footing as one of the first institutions of the kind in this country.

The Royal Danish Academy of Sciences has recently offered a prize of 320 crowns for the best discussion of the theory of the accidental errors of a clock. These errors may be divided into two classes, those arising from errors in the time observations and those depending upon the quality of the clock. These latter in turn may be divided into those depending upon the irregularities of the rate of the clock and those which are independent of the rate. The discussion must include a practical method of determining the value of each of these kinds of probable errors independent of the others.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1880.

(Continuation of papers read.)

ON PATENT LAWS AS A MEANS FOR THE ADVANCEMENT OF SCIENCE.

BY PROF. B. S. HEDRICK, of Washington, D. C.

THE proper aim of science was defined to be the making of discoveries. The discoverer of a new mineral, a new plant, a new law of nature, or a new world, has no proprietory right in his discovery. The honor and distinction he obtains is his reward. The discovery, then, cannot be the subject of a patent. The laws of nature, the properties of matter, the physical forces, the laws of their generation and government, are like the earth, the air, the water, the common property of all. Property in the former, as in the latter, is created by enactment. But in civilized communities the reason for the law is that something has been added to what was given by nature. The land has been fenced, ploughed, planted, or buildings placed upon it. That gives the foundation for proprietory right, and public policy requires that this be recognized, and civil, municipal and common law does this in the case of the land, the air, and the water. The patent laws do the same when discoveries, the properties of matter, the forces, the laws which govern them, are made to take the shape of useful inventions. The invention which the inventor created is secured to him as his property for a period at least. But note the laws themselves. It is the reflex action of the inventor that acts to advance science. Illustrations were given by referring to Watts' steam engine in advancing our knowledge of the laws of heat; the telegraph in giving an immense development to the source of magnetism and electricity; and now the telephone and other kindred inventions serve to push our knowledge into the farthest and outermost borders. The probation given by the patent laws enable the great host of investigators to carry on their researches, and instead of becoming a tax or burden to the community, they help themselves and bear a full share of the ordinary burdens of society. Reference was made to Wheatstone, Bessemer, Perkin, Graibe, Sir William Thompson, and others in Europe, and to Morse, Page, Henry, Gale, Bell, Edison, and many other members of our association, men who have greatly advanced science, and have received of the rewards which flow from the operation of patent laws.

THE MEAN RATIO OF OXYGEN TO NITROGEN IN THE ATMOSPHERE.

BY PROFESSOR E W. MORLEY.

In the afternoon Prof. E. W. Morley presented the following remarkable conclusions from experiments: When the air at a given place is cold and the barometer high, there may sometimes be a vertical descent of cold air. Samples collected at such times are more likely to approach the composition of the upper atmosphere than those collected at other times. If there be any cause which tends to produce an excess of nitrogen in the upper atmosphere, the average per cent. of oxygen in many samples collected as mentioned, will be lower than that of other samples. Therefore, to determine whether there be any difference in the composition of the lower and upper atmosphere, Professor Morley collected samples of air during each time of unusual cold and high barometer from September, 1878 to April, 1879. In 1878 the average amount of oxygen in these was 0.16 per cent. below that of other samples. In 1879 the average was 0.12 per cent. lower. Careful revision fails to detect any source of error. Professor Morley was led, therefore, to presume that the upper atmosphere, is acted on by a cause tending to remove part of the oxygen, and to pursue the inquiry by means of a series of daily analyses in duplicate of air for six months, and a comparison of the results of analysis with the thrice daily maps of the United States Signal Service. He finds a deficiency of oxygen at times, and only at the times, when a vertical descent of air at or near the place of collection may be inferred with a fair degree of probability from these maps, and sometimes a deficiency when a vertical descent may be regarded as reasonably certain.

MAXIMA AND MINIMA TIDE-PREDICTING MACHINE.

BY WILLIAM FERRILL.

This machine is merely prospective as yet, and is designed to indicate, by means of indices on its face, the times and heights of high and low water for any tide station. These have been determined heretofore by means of laborious computations. The mathematical principles upon which the proposed machine is based, and also the internal structure of the machine, are both very complex, and no idea of them can be conveniently given here. The face of the machine is to be 20 inches by 16 inches, and the depth of the case 6 or 8 inches. The face contains an hour circle 10 inches in diameter, and a lunar and solar index turning around the same centre with slightly different velocities, the one pointing out the lunar time and the other the solar time elapsed from the time of an assumed epoch, as the first of January. There is also an index moving vertically, indicating the heights of high and low water. The machine is designed to stand upon a desk, and the power is the left hand applied to a crank on the side, leaving the right hand free to record the result as read from the face of the machine. The crank is turned until the lunar index comes in conjunction with the upper or positive end of a needle, also in motion, when the solar index indicates the time of high water and the vertically moving index the height of high water. The same for low water when the lower index comes